REMARKS

Claims 1-3, 11-14, 31-33, 41-44, 58-59, 61-62, 72-78, and 80-83 are all the claims presently undergoing examination in this application. By this amendment, claims 1-3, 11, 14, 31-59, 61-62, 64-66, 69-73, and 80-84 are amended. The amendments introduce no new matter.

It is noted that the claim amendments herein, if any, are made only to more clearly and completely define the invention and to assure grammatical and idiomatic English and improved form under United States practice, and are not made to distinguish the invention over the prior art, or for any statutory requirements of patentability. Further, Applicants specifically state that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 14, 81, and 82 stand rejected under 35 USC §112, second paragraph. The claims are amended in accord with the Examiner's suggestions to obviate this rejection. Applicant respectfully requests the Examiner reconsider and withdraw the rejection of claims 14, 81, and 82.

Claims 31-33, 41-44, 77, and 82 stand rejected under 35 USC §101. The claims are amended in accord with the Examiner's suggestions to obviate this rejection. Applicant respectfully requests the Examiner reconsider and withdraw the rejection of claims 31-33, 41-44, 77, and 82.

Claims 1-2, 31-32, 58, 72, 76, and 80-83 stand rejected under 35 U.S.C. §102(e) over Miller, et al. (US Pat. App. Pub. No. 2004/0027995). Claims 14, 44, 62, 74-75, and 78 stand rejected under 35 U.S.C. §102(e) over Shah-Heydari (US 7,203,743). Claim 74 stands rejected under 35 U.S.C. §102(e) over Bertin, et al. (US 5,606,669). Claim 77 stands rejected

under 35 U.S.C. §102(e) over Larsson, et al. (US Pat. App. Pub. No. 2003/0161268). Claims 3, 11-13, 33, 41-43, 59, 61, 73, and 77 stand rejected under 35 U.S.C. §103(a) over Miller in view of Sistanizadeh, et al. (US 6,963,575).

These rejections are respectfully traversed in the following discussion.

THE CLAIMED INVENTION

The claimed invention, as exemplarily described in the embodiment of independent claim 1, relates to a node in a network. The node configures a spanning tree over a network to which a plurality of nodes are connected. The configuration includes generating a new spanning tree and switching the spanning tree in use to the new spanning tree.

The new spanning tree is generated after a network configuration change. While the new spanning tree is generated, the node continues to operate the spanning tree that existed before the configuration change. The node switches the spanning tree to be used for forwarding to the new spanning tree after the new spanning tree has become stable.

In a conventional network node, this type of spanning tree has been used to prevent data from circulating permanently in a network arranged in the form of a loop (ring).

For example, a control technique referred to as a spanning tree is known, in which, in order to prevent data from circulating permanently in a network arranged in the form of a loop (ring), a logically tree-like topology is formed by exchanging control information referred to as Bridge Protocol Data Unit (BPDU) between nodes, and logically disabling a portion of the network which is physically loop-like. This is assumed as conventional technology 1. Moreover, a control technique referred to as a high-speed spanning tree is known, which accelerates tree creation with the conventional technology 1 by extending a

method to exchange the control information, and rapidly sets up a detour path in the event of a failure by presetting the detour path. This is assumed as conventional technology 2. However, various problems existed with the conventional technologies mentioned above.

First, there was the problem that, due to congestion, delayed arrival and loss of frames occurred. With the conventional technology 1, since the spanning tree was stopped and reconstructed from the beginning at the time of addition/remove of nodes and links that belong to the spanning tree, due to the fact that the entire network was stopped for an extended time during reconstruction and congestion occurred, such that sometimes arrival of frames was delayed or frames were lost. With the conventional technology 2, since the spanning tree was reconstructed gradually while forwarding of a data frame was stopped locally at the time of addition/remove of nodes and links that belong to the spanning tree, a portion of the network was stopped and congested during reconstruction, such that sometimes arrival of frames was delayed or frames were lost.

Second, there was the problem that the network stopped at the time of reconfiguration of the spanning tree, such as addition/remove of nodes that belong to the spanning tree. With the conventional technology 1, since the spanning tree was stopped and reconstructed from the beginning at the time of addition/remove of nodes that belong to the spanning tree, sometimes the entire network stopped for a long time during reconstruction. With the conventional technology 2, since the spanning tree was reconstructed gradually while forwarding of data frame was stopped locally at the time of addition/remove of nodes that belong to the spanning tree, sometimes a portion of the network was stopped during reconstruction.

Third, there was the problem that the traffic load could not be distributed. With the

conventional technologies 1 and 2, since the cost was calculated using link capacity and used to select a path at the time of spanning tree construction, it was impossible to change the path for dynamic load distribution according to the traffic.

Fourth, there was the problem that due to reconfiguration of the spanning tree, the network stopped when attempting load distribution. With the conventional technology 1, when attempting to vary the cost dynamically according to the traffic status, the spanning tree was stopped temporarily and reconstructed to change the path, such that sometimes the entire network stopped for an extended time during reconstruction. With the conventional technology 2, when attempting to vary the cost dynamically according to the traffic status, a portion of the spanning tree was reconstructed gradually to change the path while forwarding of the data frame was stopped locally, such that sometimes a portion of the network stopped during reconstruction.

Fifth, there was the problem that the path with the minimum cost to a destination was not always selected. With the conventional technologies 1 and 2, since only one system of spanning tree was set up on the network and only one root node was defined on the network by a priority value and a MAC address, which were preset for each node, to create a single tree, when nodes located at the ends of the tree communicated with each other, sometimes, even if a different, shortest path existed, it was blocked and a lengthy path was taken.

Sixth, there was the problem that the load concentrated in the vicinity of the root node while the link utilization rate was low. With the conventional technologies 1 and 2, since only one system of spanning tree was set up on the network and only one root node was defined on the network by a priority value and a MAC address, which were preset for each node, to create a single tree, the links not used even though they are located at the ends of the

tree appeared, reducing the link utilization rate. On the contrary, sometimes the traffic concentrated in the vicinity of the root node, increasing the possibility of occurrence of congestion.

Seventh, there was the problem that tree construction in the event of a root node failure took time, the network being stopped during that period. With the conventional technology 1, since only one system of spanning tree was set up on the network and there was only one root node, if a failure occurred at the root node, the spanning tree was stopped and reconstructed from the beginning, such that sometimes the entire network was stopped for an extended time during reconstruction. With the conventional technology 2, if a failure occurred at the root node, the spanning tree was reconstructed gradually while forwarding of the data frame was stopped locally, such that sometimes a portion of the network was stopped during reconstruction.

Eighth, there was the problem that in the section using IEEE 802.1D, switching of the route was slow in the event of a failure, also taking a long time to reconfigure the spanning tree. This is because, with the conventional technology 1, it sometimes took several tens of seconds until data could be exchanged at the time of construction of the tree.

Ninth, with the conventional technologies 1 and 2, since there was only a single tree, the traffic concentrated and congested in the vicinity of the root node, such that sometimes arrival of frames was delayed or frames were lost.

The present invention, on the other hand, provides a network system, a spanning tree configuration method, a spanning tree configuration node, and a spanning tree configuration program, having multiple advantages over the prior art. The present invention is capable of <u>lowering the probability of occurrence of congestion</u> and <u>reducing the frequency with which</u>

delayed arrival or loss of frames occurs due to congestion. The present invention is capable of reconfiguring a spanning tree, such as performing addition/remove of a node that belongs to the spanning tree, without stopping the network. The present invention is capable of distributing the traffic load. The present invention is capable of distributing the load without stopping the network for spanning tree reconfiguration that accompanies a path change. In the present invention, a path with the minimum cost to a destination is selected. The present invention is capable of increasing the utilization ratio of a link, and distributing the load without concentrating the load in the vicinity of the root node. The present invention is capable of circumventing a network halt due to a root node failure. The present invention is capable of preventing the spanning tree from being set up by passing through the IEEE802.1D-using section, speeding up switching and route changes in the event of a failure, and reducing the possibilities of occurrence of congestion and loss of a frame.

THE §112 REJECTIONS

Claims 14, 81, and 82 stand rejected under 35 U.S.C. §112, second paragraph. Applicant respectfully traverses this rejection.

With respect to claim 14, the Examiner alleges, "it is not clear whether "a root node" refers to the same root node cited in line 5." Office Action, p. 3.

Claim 14 clearly recites, "generating a spanning tree in which each node in the network serves as a root node, and forwarding a frame (frames) using a spanning tree in which the destination serves as a root node." Both instances of the phrase "a root node" in claim 14 are part of the larger and more descriptive phrase "serves as a root node." Thus, both instances of "a root node," as actually recited "serves as a root node," clearly further

describe characteristics of nodes that are otherwise unambiguously identified in the claim.

Claims 81 and 82 are hereby amended in accord with the Examiner's suggestions.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 14, 81, and 82 under §112, second paragraph.

THE PRIOR ART REJECTIONS

The Miller Reference

Claims 1-2, 31-32, 58, 72, 76, and 80-83 stand rejected under 35 U.S.C. §102(e) over Miller. Claims 3, 11, 33, 41, 59, and 61 stand rejected under 35 U.S.C. §103(a) over Miller in view of Sistanizadeh. Applicant respectfully traverses these rejections.

The Examiner alleges that certain features of the claimed invention are disclosed by Miller. Applicant respectfully traverses these rejections. Applicant submits that there are features of the claimed invention which are neither disclosed nor suggested by Miller.

Miller fails to disclose or suggest at least "A node that configures a spanning tree over a network to which a plurality of nodes are connected, comprising: generating a new spanning tree after a network configuration change while continuing to operate only the spanning tree that existed before the configuration change, and switching the spanning tree to be used for forwarding to said new spanning tree only after said new spanning tree has been stable," as recited in independent claim 1.

The Examiner alleges that Miller discloses the features of claims 1, 31, 58, 72, and 80-81 in paragraphs [0011], [0035], and [0060]. The Examiner has failed make out a *prima facie* rejection, as he has failed to indicate wherein each feature of the claims may allegedly be found in the reference. However, in the interest of expediting prosecution, Applicant will

address what he believes to be the substance of the Examiner's rejection.

Miller discloses, "*The present invention is directed to providing a technique by which the nodes of the router network execute a reconfiguration decision, eventually resulting in a new state of the network in which messages are forwarded using a new spanning tree.*" Miller, para. [0011]. The cited passage fails to address or disclose or suggest how the reconfiguration is executed, but instead describes only results after such reconfiguration has been completed.

Miller discloses, "*In accordance with the principles of the present invention, a reconfiguration capability is provided for distributed network environments, such as those included in publish/subscribe systems. As one example, a publish/subscribe system is non-disruptively reconfigured such that no messages are lost during the reconfiguration. Further, the reconfiguration is performed without quiescing the system (i.e., without having to suspend routing of messages). Additionally, properties of various messages within the system are preserved. For example, various messages have an ordering requirement associated therewith, and that ordering requirement is preserved during the reconfiguration. The present invention advantageously enables reconfiguration to be performed without affecting the equalities of service guaranteed to the clients.*" Miller, para. [0035].

However, the cited passage discloses only claimed benefits of Miller's invention, without disclosing how the invention operates. In particular, the passage fails to disclose the features recited in the claims of the present invention.

Finally, Miller discloses, "*At a topology change, i.e., a reconfiguration, configuration manager 312 distributes information allowing each router 108 to configure a new topology in Table-1. For a period of time, some messages are routed using Table-0 (the old table)*

while others use Table-1 (the new table). Eventually, the configuration stabilizes to a point where all routers are using the new table for all messages. After this time, it is possible for the configuration manager to initiate a new reconfiguration. When the next reconfiguration occurs, Table-0 is the new table and Table-1 is the old table. Thus, on odd-numbered reconfigurations, Table-1 is the new table, and on even-numbered configurations, Table-0 is the new table." Miller, para. [0060].

Thus, Miller clearly discloses in the cited passage that there is a period of overlap in which both the old and new table are simultaneously in use.

The present invention, in sharp contrast, generates a new spanning tree after a network configuration change while continuing to operate only the spanning tree that existed before the configuration change, and switches the spanning tree to be used for forwarding to said new spanning tree only after said new spanning tree has been stable. Thus, in the present invention, there is no such overlap period in which the old and new spanning trees are simultaneously in use.

Claims 2-3, 11, 31-33, 59, 61, 72-73, and 80-83 disclose similar features. The rejections of claims 2-3, 11, 31-33, 59, 61, 72-73, and 80-83 are traversed on substantially similar grounds.

Claim 76 recites a feature, "creating a tree after a change using an auxiliary system." The Examiner has failed to cite any reference which discloses or suggests such a feature. Further, the Examiner fails to allege that such a feature is disclosed or suggested in any reference, other than the general reference to Miller, para. [0011], [0035], [0060].

Thus, the cited references fail to disclose or suggest all features of any of the claims.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw

the rejections of claims 1-3, 11, 31-33, 41, 58-59, 61, 72, 76, and 80-83 over Miller.

The Shah-Heydari Reference

Claims 14, 44, 62, 74-75, and 78 stand rejected under 35 U.S.C. §102(e) over Shah-Heydari. Applicant respectfully traverses this rejection. Applicant submits that there are features of the claimed invention which are neither disclosed nor suggested by Shah-Heydari.

With regard to claim 14, Shah-Heydari fails to disclose or suggest at least "A node that configures a spanning tree over a network to which a plurality of nodes are connected, comprising generating a spanning tree in which each node in the network serves as a root node, and forwarding a frame (frames) using a spanning tree in which the destination serves as a root node," as recited in the claim. Claims 44, 62, and 78 recite substantially similar features.

The Examiner alleges that the claimed invention is disclosed by Shah-Heydari in Fig. 5 and 9, and col. 1, lines 48-60.

Instead, the cited reference discloses only, "*In a hierarchical tree-based protection scheme, a mesh network node is designated as a root node of a hierarchical protection tree. The root node invites each adjacent node to become its child within the tree. If the inviting node provides a more capacious protection path to the root node (i.e. a path to the root node with more capacity) than is currently enjoyed by the invitee, the invitee designates the inviting node as its primary parent and assumes a new tree position. Otherwise, the invitee designates the inviting node as a backup parent. A node assuming a new tree position invites all adjacent nodes except its parent to become its child. The invitations propagate throughout the network until a spanning hierarchical protection tree is formed.*" Shah-Heydari, col. 1, lines 48-60.

Thus, Shah-Heydari clearly discloses only a conventional network spanning tree having a single root node. All other nodes joining the network in Shah-Heydari have their primary and backup parent nodes determined according to which provides the most capacious protection path to the single root node.

Therefore, Shah-Heydari fails to disclose or suggest at least this feature of the claims.

The rejections of claims 44, 62, and 78 are traversed on substantially similar basis.

With regard to claim 74, Shah-Heydari fails to disclose or suggest at least "A spanning tree configuration method in a network to which a plurality of nodes are connected, comprising the step of: making a new node participate in an auxiliary spanning tree only, not in an existing spanning tree, when adding the new node," as recited in the claim.

The Examiner alleges that the claimed invention is disclosed by Shah-Heydari at col. 9, lines 48-56.

Instead, the cited reference discloses only, "*When a new (i.e. auxiliary) node is added to the network, the node is incorporated into the hierarchical protection tree's structure using fundamentally the same process as was used to initially form the tree. The new node initiates the incorporation by initially sending a "request" message to each of its neighbors to cause them to each respond with an invitation message for the new node to become its child. Advantageously, the impact of adding a node in this manner is also limited to the network area surrounding the new node.*" Shah-Heydari, col. 9, lines 48-56.

Thus, in Shah-Heydari, the new node is incorporated into the existing hierarchical protection tree's structure. In contrast, the present invention recites that a newly added node is not added to the existing spanning tree.

Therefore, Shah-Heydari fails to disclose or suggest at least this feature of the claim.

With regard to claim 75, Shah-Heydari fails to disclose or suggest at least "A spanning tree configuration method in a network to which a plurality of nodes are connected, comprising the step of: making a removing node participate in an existing spanning tree only, not in an auxiliary spanning tree, when removing the node," as recited in the claim.

The Examiner alleges that the claimed invention is disclosed by Shah-Heydari. "*... (disconnecting a node for a spanning hierarchical tree by designating a backup parent of the disconnected node in the tree to be a primary parent..., col. 2, lines 16-22).*" Office Action, p. 6.

Instead, the cited reference discloses only, "*In accordance with another aspect of the present invention there is provided a method of reconnecting a node disconnected from a spanning hierarchical protection tree in a mesh network to the spanning hierarchical protection tree comprising: designating a backup parent of the disconnected node in the tree to be a primary parent of the disconnected node in the tree; and from the disconnected node, sending an invitation to become a child of the disconnected node in the tree to each adjacent node of the disconnected node that is not the primary parent.*" Shah-Heydari, col. 2, lines 16-22.

Thus, in the cited reference, Shah-Heydari discloses a method to re-connect a node which is already disconnected. In contrast, the present invention recites a feature of removing a node from an existing spanning tree.

Therefore, Shah-Heydari fails to disclose or suggest at least this feature of the claim.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 14, 44, 62, 74-75, and 78 over Shah-Heydari.

The Bertin Reference

Claim 74 stands further rejected under 35 U.S.C. §102(e) over Bertin. Applicant respectfully traverses this rejection. Applicant submits that there are features of the claimed invention which are neither disclosed nor suggested by Bertin.

With regard to claim 74, Bertin fails to disclose or suggest at least "A spanning tree configuration method in a network to which a plurality of nodes are connected, comprising the step of: making a new node participate in an auxiliary spanning tree only, not in an existing spanning tree, when adding the new node," as recited in the claim.

The Examiner alleges that the claimed invention is disclosed by Bertin in the Abstract; col. 2, line 63 - col. 3, line 20; and claims 1 and 6, step 'c'.

Instead, the cited reference discloses only, "*A topology manager within a data communication network including a number of nodes interconnected by bi-directional links, wherein each said node is provided with means for dynamically setting and storing within the node a full topology database including full parent-node relationship references. The system is is [sic] capable of fast path determination and fast spanning tree recovery based on the topology database contents.*" Bertin, Abstract. "*These objects are achieved in a data communication network including several nodes interconnected by bi-directional links for enabling the transmission of data packets and control data between the nodes. The nodes, at any given moment, are organized into a spanning tree including, a root node and children nodes organized in a parent-children relationship, with each node (except the root node) having a single parent node. Each node is provided with storage means for storing a topology database including a Parent Table, all the nodes of the tree, with each node (except the root node) pointing to its parent node and to a Link Table via out-link pointers, the Link*

Table including dual link pointers for pointing to respective dual links within the Link Table and means for assigning each link reference with a bit position indicating whether said link currently participates to the spanning tree or not; means for using the Parent Table and Link Table contents for organizing the tree arrangement at will; and means for dynamically updating the node topology database including the Parent Table and the Link Table upon each spanning tree (re)organization." Bertin, col. 2, line 63 – col. 3, line 15. "...*c) spanning tree update logic for updating the link tables and the parent table upon a change in network topology affecting the current spanning tree, said spanning tree update logic further including i) means for scanning the parent table memory to detect an entry identifying a first node for which no parent node is identified, said means assigning the root position in a new spanning tree to the first node, ii) means for reading the parent table and link table for the first node to identify at least one adjacent node which satisfies predetermined criteria for a parent node to the first node, marking the adjacent node as a parent to the first node and amending the parent tables and link tables accordingly, and iii) means for repeating the operations performed by said reading means with each identified adjacent node being assigned the role as a first node until all nodes have a parent and amending the parent tables and link tables accordingly.*" Bertin, claim 1.

Thus, Bertin clearly discloses only a conventional network spanning tree in which only a single spanning tree is (re)organized at any time. Each node, at any point in time, points to its parent node in the spanning tree. Bertin discloses that a link (not a node) may or may not participate in the spanning tree. Bertin further discloses the each node in the existing spanning tree has its parent and link tables amended dynamically.

Bertin fails to disclose or suggest modifying only an auxiliary spanning tree, which is

not the existing spanning tree.

Further, the cited reference fails to address the particular case of adding a new node to the network, as distinct from a topology change of existing nodes on a network.

In contrast, the present invention recites the feature that a new node, when added to the network, participates in an auxiliary spanning tree only, not the existing spanning tree.

Therefore, Bertin fails to disclose or suggest at least this feature of the claims.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 74 over Bertin.

The Larsson Reference

Claim 77 stands rejected under 35 U.S.C. §102(e) over Larsson. Applicant respectfully traverses this rejection. Applicant submits that there are features of the claimed invention which are neither disclosed nor suggested by Larsson.

With regard to claim 77, Larsson fails to disclose or suggest at least "A spanning tree configuration method in a network to which a plurality of nodes are connected, comprising the step of: using a link free bandwidth to calculate a cost," as recited in the claim.

The Examiner alleges that the claimed invention is disclosed by Larsson in para. [0024], [0026], [0029], and [0148].

Instead, the cited reference discloses only a free path routing method. Para. [0024] and [0026] describe prior art routing technology (Interference Free Channel – Only Primary Interference Considered), and [0029] describes prior art routing technology (Interference Free Channel – Both Primary and Secondary Interference Considered – Cluster Based). The reference fails to disclose or suggest a spanning tree configuration method.

Para. [0148] discloses only, "*FIG. 7 shows a tree rooted at source with ID 5. This*

represents the phase of connection set-up of a first flow when the CFPR algorithm has generated preliminary connections consisting of paths, channels and adapted link parameters. In this particular implementation of the CFPR algorithm, the lowest TS number is always chosen if there exist equally good time slots. This is why slot numbers are assigned in number order from the source node." Larson fails to disclose or suggest that the tree referenced in para. [0148] is a spanning tree; instead, Fig. 7 clearly depicts the tree rooted at source ID '5' is not spanning.

Thus, Larsson fails to disclose or suggest a spanning tree configuration method.

Therefore, Larsson fails to disclose or suggest at least this feature of the claims.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 77 over Larsson.

CONCLUSION

In view of the foregoing, Applicant submits that claims 1-3, 11-14, 31-33, 41-44, 58-59, 61-62, 72-78, and 80-83, all the claims presently undergoing examination in the application, are patentably distinct over the prior art of record and are allowable, and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below to discuss any other changes deemed necessary for allowance in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. The Commissioner is authorized to charge any deficiency in fees, including extension of time fees, or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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Donald A. DiPaula, Esq.
Registration No. 58,115

Sean M. McGinn, Esq.
Registration No. 34,386

McGinn Intellectual Property Law Group, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254